Claims Listing

1. (Amended herein) A gas sensor device comprising:

a semiconductor layer having a surface, said semiconductor layer comprising a material selected from the group consisting of silicon carbide, diamond, Group III nitrides, alloys of Group III nitrides, zinc oxide, and any combinations thereof;

one or more catalytic gate-electrodes deposited on said surface;

one or more ohmic contacts deposited on said surface; and

a passivation [layer] layer;

wherein the gas sensor device is selected from the group consisting of a HFET, a MISFET having a silicon nitride passivation layer, a MESFET, a MISHFET, a capacitor, a resistor, and a diode formed from layers of different dopings in a semiconductor device.

2. (Original) The device of claim 1, wherein said semiconductor layer comprises a material selected from the group consisting of silicon carbide, gallium nitride, aluminum gallium nitride, and any combinations thereof.

3. (Canceled herein).

4. (Canceled herein).

5. (Original) The device of claim 1, wherein said one or more catalytic gate-electrodes comprises a material selected from the group consisting of metal, metal oxide, metal alloy, combination of metal oxides, and any combinations thereof.

6. (Original) The device of claim 5, wherein said metal is selected from the group consisting of platinum, ruthenium, silver, palladium, iridium, indium, rhodium, titanium, aluminum, gold, nickel, rhenium, tantalum and osmium, and any combinations thereof.

7. (Original) The device of claim 5, wherein said metal is selected from the group consisting of tantalum, osmium, and any combinations thereof.

8. (Original) The device of claim 5, wherein said metal oxide is selected from the group consisting of gallium oxide, silver oxide, indium oxide, vanadium oxide, Mn_2O_3, CuO, Cr_2O_3, Co_2O_3, ZnO, Ge_2O_3, FeO_2, bismuth molybdates, and any combinations thereof.

9. (Original) The device of claim 5, wherein said metal alloy is selected from the group consisting of platinum/rhodium, palladium/iridium, platinum/titanium/gold, platinum/ruthenium, platinum/iridium, platinum/gold, and any combinations thereof.

10. (Original) The device of claim 5, wherein said combination of oxides is selected from the group consisting of platinum/tin oxide, platinum/indium oxide, zinc oxide/vanadium oxide, indium oxide/tin oxide/manganese oxide, and any combinations thereof.

11. (Original) The device of claim 1, wherein said one or more catalytic gate-electrodes comprises a material of the formula ABO_3 where A is lanthanum and B is any transition metal or alkaline earth metal.

12. (Original) The device of claim 1, wherein said one or more ohmic contacts comprises a material selected from the group consisting of titanium, aluminum, gold, nickel, chromium, indium, and any combinations thereof.

13. (Original) The device of claim 1, wherein said passivation layer is interposed between said semiconductor layer and said one or more catalytic gate-electrodes.

14. (Original) The device of claim 1, wherein said one or more catalytic gate electrodes are uncovered by said passivation layer.

15. (Original) The device of claim 1, wherein said passivation layer comprises a material selected from the group consisting of silicon nitride, silicon dioxide, MgO, Sr_2O_3, ZrO_2, Ln_2O_3, TiO_2, AlN, carbon, and any combinations thereof.

16. (Original) The device of claim 1, wherein said semiconductor layer comprises a heterostructure

barrier layer.

17. (Original) The device of claim 1, wherein said semiconductor layer comprise at least one layer that is doped.

18. (Original) The device of claim 1, further comprising a means for encapsulation.

19. (Original) The device of claim 1, wherein the gas sensor is a flip-chip further comprising a layer of platinum and/or gold deposited on at least a portion of said one or more ohmic contacts and/or said one or more catalytic gate-electrodes.

20. (Original) The device of claim 1, wherein the gas sensor is operable in an ambient environment ranging from about minus 40 °C to about 800 °C.

21. (Original) The device of claim 1, further comprising a means for heating.

22. (Original) The device of claim 1, wherein the gas sensor is capable of sensing a gas selected from the group consisting of: NO, NO_2, N_2O, NH_3, CO, SO, SO_2, SO_3, CO_2, O_2, H_2, hydrocarbons and any combinations thereof.

23. (Original) The device of claim 1, wherein each of the one or more catalytic gate electrodes senses a different gas.

24. (Original) The device of claim 1, wherein each of said one or more catalytic gate electrodes is a stack of catalytic material layers, each of said catalytic material layers comprising a material selected from the group consisting of metal, metal oxide, metal alloy, combination of metal oxides, and any combinations thereof.

25. (Amended herein) A gas sensor device comprising:

a semiconductor substrate having a surface, said semiconductor substrate comprising a material selected from the group consisting of silicon carbide, diamond, Group III nitrides, alloys of

Group III nitrides, zinc oxide, and any combinations thereof and comprising at least one doped layer;

one or more catalytic gate-electrodes deposited on said surface;

one or more ohmic contacts deposited on said surface;

a passivation layer deposited on at least a portion of said surface; and

means for encapsulating the gas sensor [device] device;

wherein the gas sensor device is selected from the group consisting of a HFET, a MISFET having a silicon nitride passivation layer, a MESFET, a MISHFET, a capacitor, a resistor, and a diode formed from layers of different dopings in a semiconductor device.

26. (Original) The device of claim 25, wherein said semiconductor layer comprises a material selected from the group consisting of silicon carbide, gallium nitride, aluminum gallium nitride, and any combinations thereof.

27. (Canceled herein).

28. (Canceled herein).

29. (Original) The device of claim 25, wherein said one or more catalytic gate-electrodes comprises a material selected from the group consisting of metal, metal oxide, metal alloy, combination of metal oxides, and any combinations thereof.

30. (Original) The device of claim 29, wherein said metal is selected from the group consisting of platinum, ruthenium, silver, palladium, iridium, indium, rhodium, titanium, aluminum, gold, nickel, rhenium, tantalum and osmium, and any combinations thereof.

31. (Original) The device of claim 29, wherein said metal is selected from the group consisting of tantalum, osmium, and any combinations thereof.

32. (Original) The device of claim 29, wherein said metal oxide is selected from the group consisting of gallium oxide, silver oxide, indium oxide, vanadium oxide, Mn_2O_3, CuO, Cr_2O_3, Co_2O_3, ZnO, Ge_2O_3, FeO_2, bismuth molybdates, and any combinations thereof.

33. (Original) The device of claim 29, wherein said metal alloy is selected from the group consisting of platinum/rhodium, palladium/iridium, platinum/titanium/gold, platinum/ruthenium, platinum/iridium, platinum/gold, and any combinations thereof.

34. (Original) The device of claim 29, wherein said combination of oxides is selected from the group consisting of platinum/tin oxide, platinum/indium oxide, zinc oxide/vanadium oxide, indium oxide/tin oxide/manganese oxide, and any combinations thereof.

35. (Original) The device of claim 25, wherein said one or more catalytic gate-electrodes comprises a material of the formula ABO_3 where A is lanthanum and B is any transition metal or alkaline earth metal.

36. (Original) The device of claim 25, wherein said one or more ohmic contacts comprises a material selected from the group consisting of titanium, aluminum, gold, nickel, and any combinations thereof.

37. (Original) The device of claim 25, wherein said passivation layer is interposed between said semiconductor layer and said one or more catalytic gate-electrodes.

38. (Original) The device of claim 37, wherein said passivation layer comprises a material selected from the group consisting of silicon nitride, silicon dioxide, MgO, Sr2O3, ZrO_2, Ln_2O_3, TiO_2, and any combinations thereof.

39 (Original) The device of claim 25, wherein said semiconductor layer comprises a heterostructure barrier layer.

40. (Original) The device of claim 25, further comprising a layer of platinum and/or gold deposited on at least a portion of said one or more ohmic contacts and/or said one or more catalytic gate-electrodes.

41. (Original) The device of claim 25, wherein said device is operable in an ambient environment ranging from about minus 40 °C to about 800 °C.

42. (Original) The device of claim 25, wherein the gas sensor is a flip-chip further comprising a layer of platinum or gold deposited on at least a portion of said one or more ohmic contacts and/or said one or more catalytic gate-electrodes.

43. (Original) The device of claim 25, further comprising a means for heating.

44. (Original) The device of claim 25, wherein the gas sensor is capable of detecting a gas selected from the group consisting of: NO, NO_2, N_2O, NH_3, CO, SO, SO_2, SO_3, CO_2, O_2, H_2, hydrocarbons and any combinations thereof.

45. (Original) The device of claim 25, wherein each of the one or more catalytic gate electrodes senses a different gas.

46. (Original) The device of claim 25, wherein each of said one or more catalytic gate electrodes is a stack of catalytic material layers, each of said catalytic material layers comprising a material selected from the group consisting of metal, metal oxide, metal alloy, combination of metal oxides, and any combinations thereof.

47. (Amended herein) A gas sensor device comprising:

a semiconductor substrate having a surface, said semiconductor substrate comprising a material selected from the group consisting of silicon nitride, silicon carbide, diamond, Group III nitrides, alloys of Group III nitrides, zinc oxide, and any combinations thereof;

one or more catalytic gate-electrodes deposited on said surface; and

one or more ohmic contacts deposited on said surface,

a layer of platinum or gold deposited on at least a portion of said one or more ohmic contacts and/or said one or more catalytic gate-electrodes[.];

wherein the gas sensor device [being] is a flip-chip device and wherein the gas sensor device is selected from the group consisting of a HFET, a MISFET having a silicon nitride passivation layer, a MESFET, a MISHFET, a capacitor, a resistor, and a diode formed from layers of different dopings in a semiconductor device.

48. (Original) A gas sensor device comprising:

a semiconductor substrate having a surface, the semiconductor substrate comprising a material selected from the group consisting of silicon carbide, diamond, Group III nitrides, alloys of Group III nitrides, zinc oxide, and any combinations thereof;

an insulating layer;

one or more catalytic gate-electrodes deposited on a surface of said insulating layer; and

one or more ohmic contacts deposited on a surface of said semiconductor substrate,

the gas sensor being a MISFET.

49. (Original) A device as in claim 48, wherein said insulating layer comprises silicon dioxide.

50. (Original) A device as in claim 48, wherein said insulating layer comprises silicon nitride.

51. (Original) A gas sensor device comprising:

a semiconductor substrate having a heterostructure barrier layer and a surface, said semiconductor substrate comprising a material selected from the group consisting of silicon carbide, diamond, Group III nitrides, alloys of Group III nitrides, zinc oxide, and any combinations thereof;

one or more catalytic gate-electrodes deposited on said surface;

one or more ohmic contacts deposited on said surface; and

a passivation layer deposited on at least a portion of said surface underneath the one or more catalytic gate-electrodes,

the gas sensor being a MISHFET.